# Strategic Value Analysis:
## *Wind Resources Economics*

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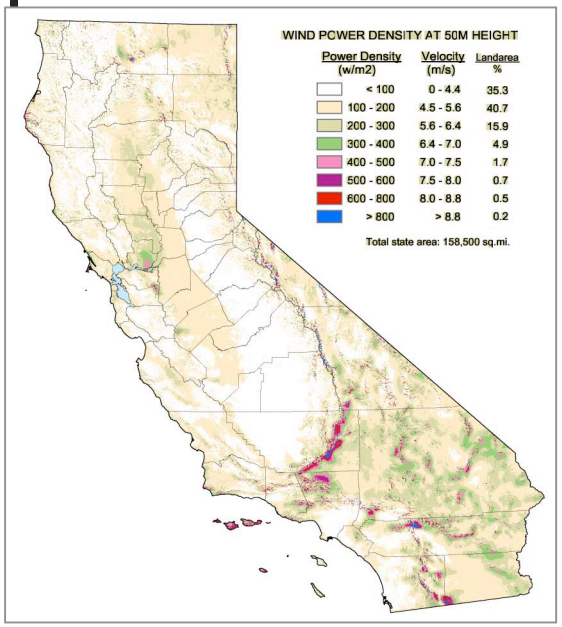
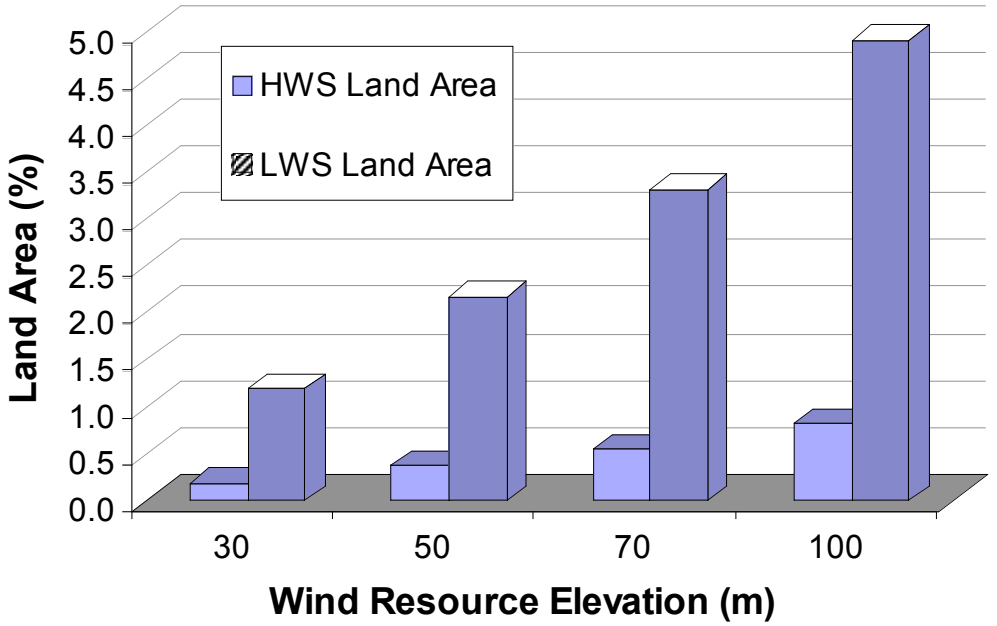
July 1, 2005 IEPR Workshop


# Overview

- SVA Wind Results
  - How Much?
  - Where?
  - When?
- Methodology/Approach
  - How did we get there?
  - Feasibility & Priorities?
- Next Steps

# Technical Wind Potential




| | High Wind Speed | | | Low Wind Speed | | |
|---|---|---|---|---|---|---|
| Height m | Land Area Percent | Capacity MW | AEP GWh | Land Area Percent | Capacity MW | AEP GWh |
| 30 | 0.2 | 4775 | 15478 | 1.2 | 30897 | 100144 |
| 50 | 0.4 | 9586 | 31070 | 2.2 | 56196 | 182144 |
| 70 | 0.6 | 14346 | 46500 | 3.3 | 85598 | 277441 |
| 100 | 0.8 | 21339 | 69164 | 4.9 | 126558 | 410199 |

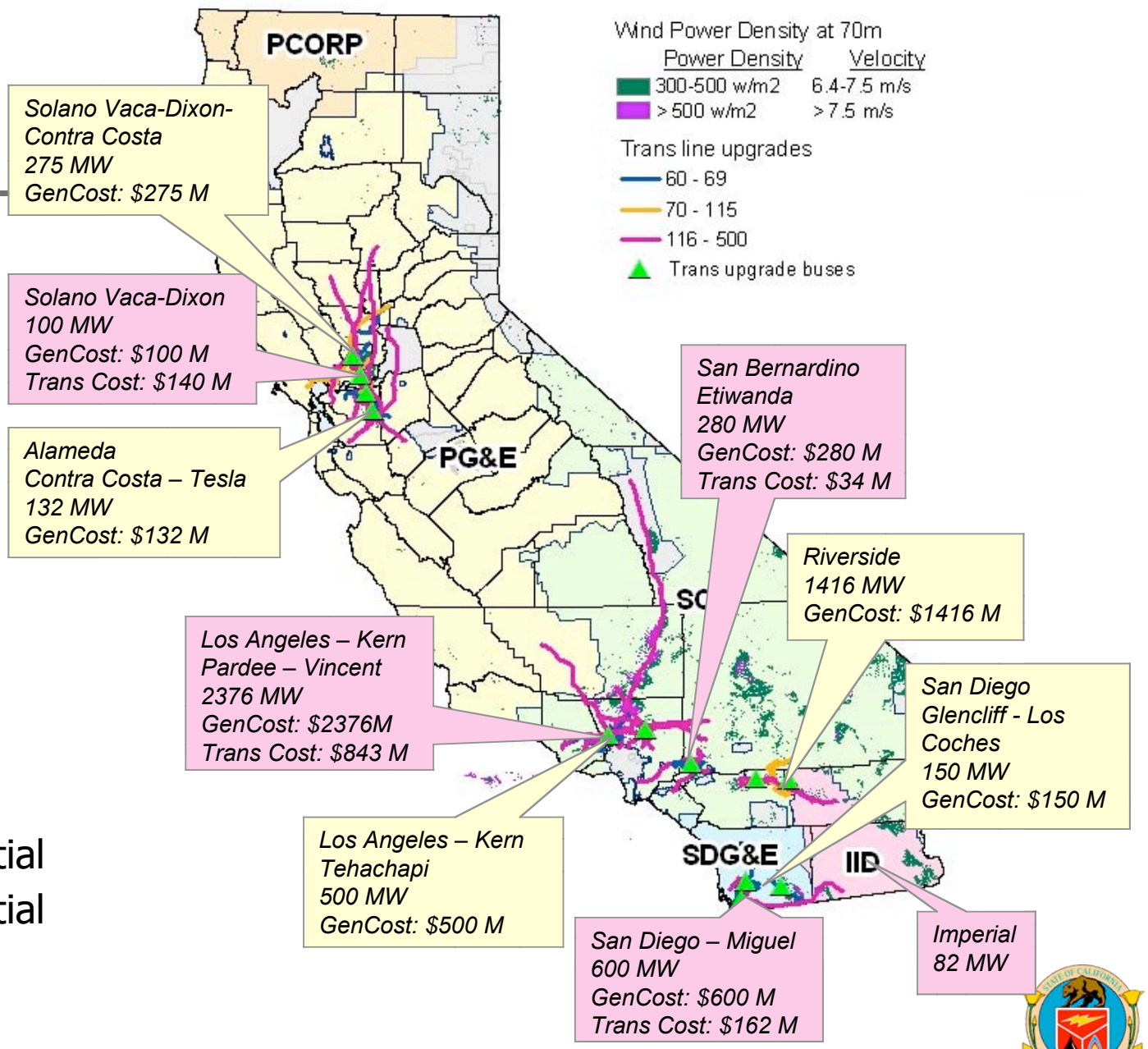
# Unique to SVA Approach

- *Timeframe* – 2010 checkpoint and 2017 RPS goal
- *Locational Evaluation* – identify transmission "hotspots" (weaknesses in the grid) using power flow analysis
- *Temporal Evaluation* – economic feasibility and priority in terms of LCOE and transmission infrastructure costs and other criteria (non-energy benefits)

# SVA Wind Results

| Filters | HWS (MW) | LWS (MW) |
|---|---|---|
| Technical Potential | 14,346 | 85,598 |
| Economic Potential | | |
| Locational | 6,901 | 20,956 |
| Temporal - 2010 requires mimimal transmission upgrades | 2,473 | -- |
| Temporal - 2017 requires major transmission infrastructure | 3,438 | 304 |

# 2010 & 2017 Economic Wind Results

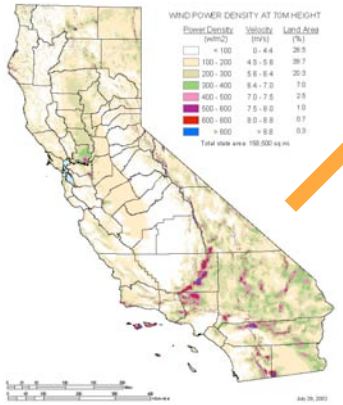


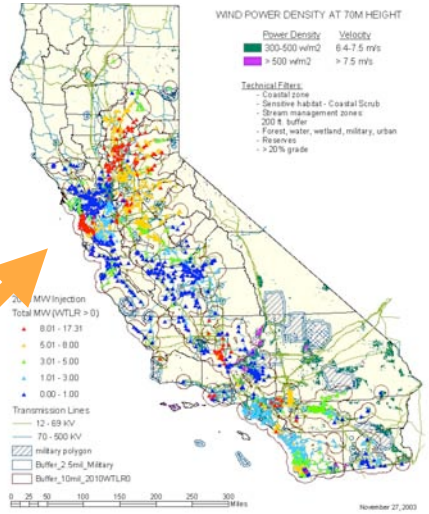

2010 potential

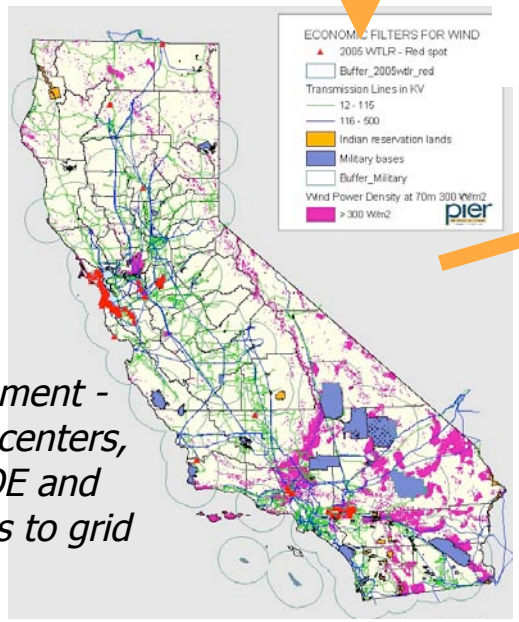
2017 potential

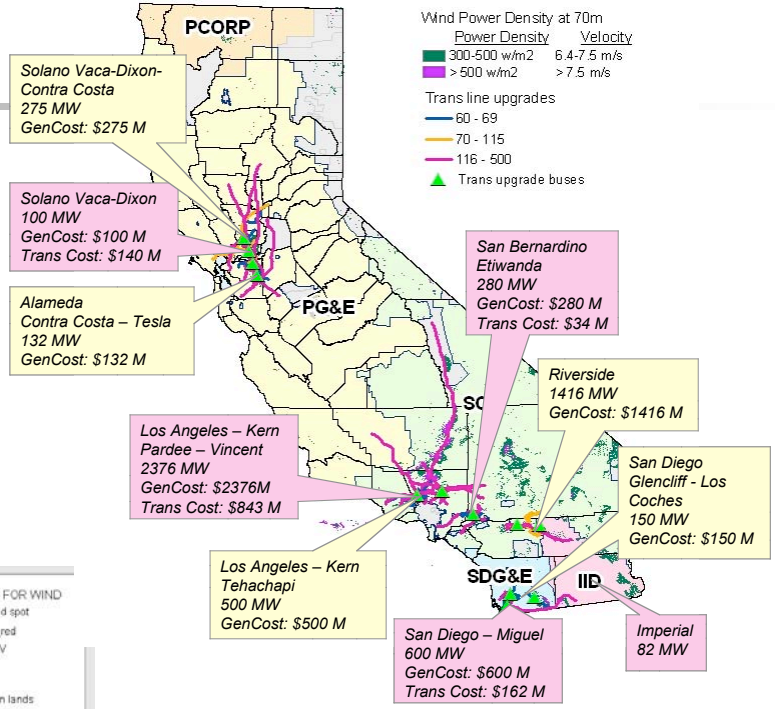
*2. Transmission lines & "hotspots" overlap on technical wind potential*

*4. Resource locations for 2010 & 2017 development opportunities*





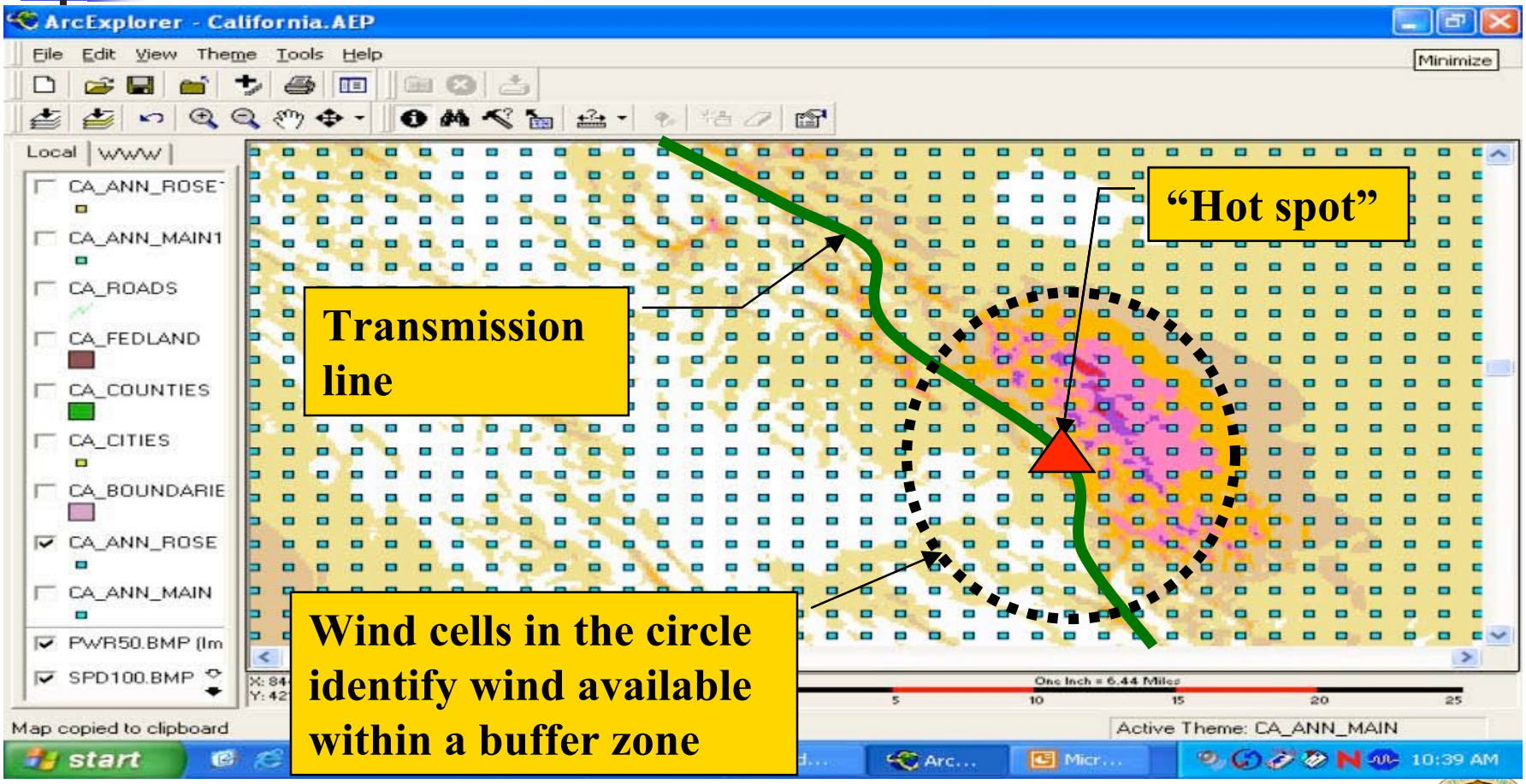




*1. State's Wind Resource Assessment*

*3. Economic alignment - proximity to load centers, transmission, LCOE and maximum benefits to grid*

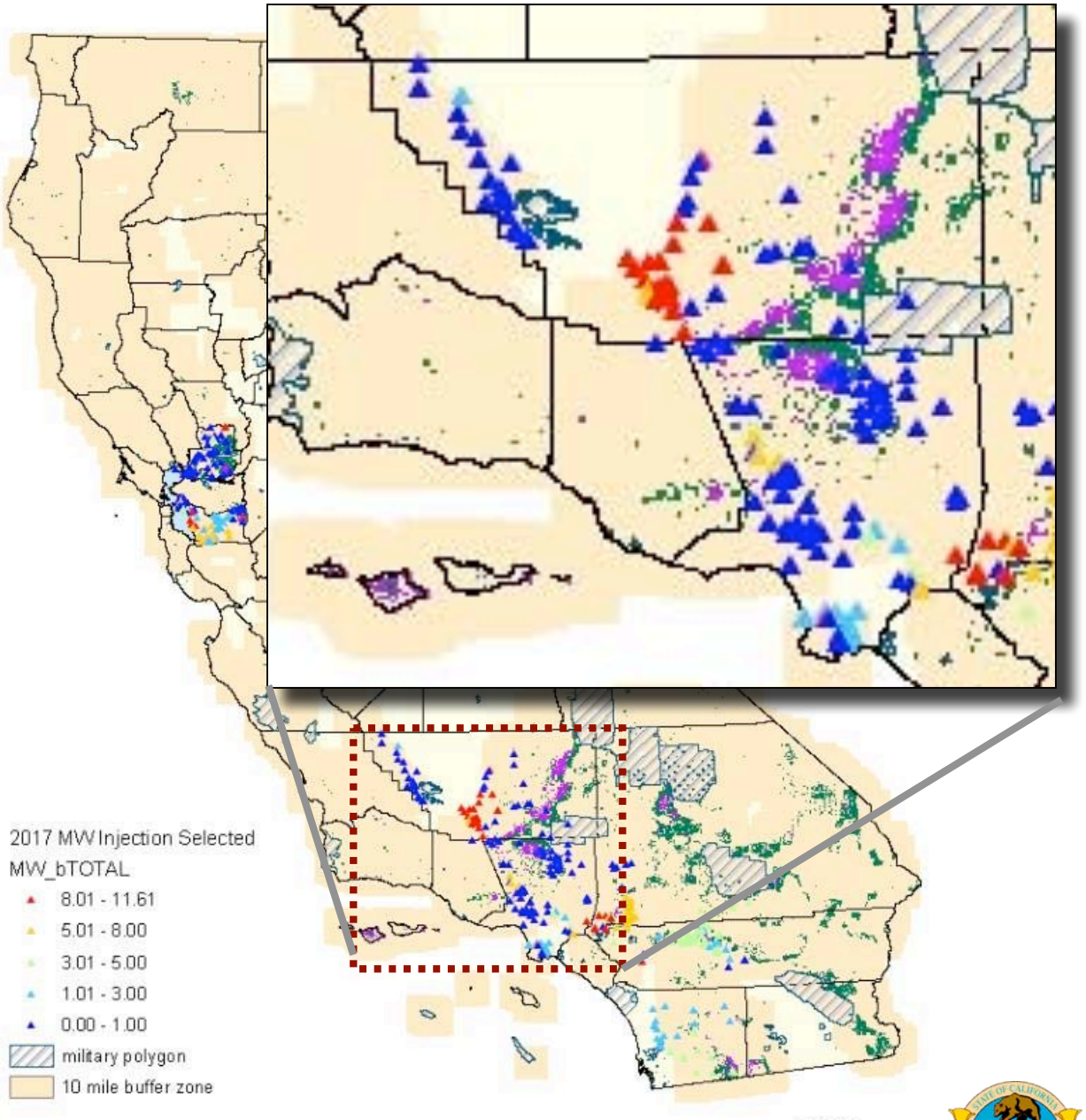
**Strategic Roadmap**

# Wind Resources Mapped to Hot Spots

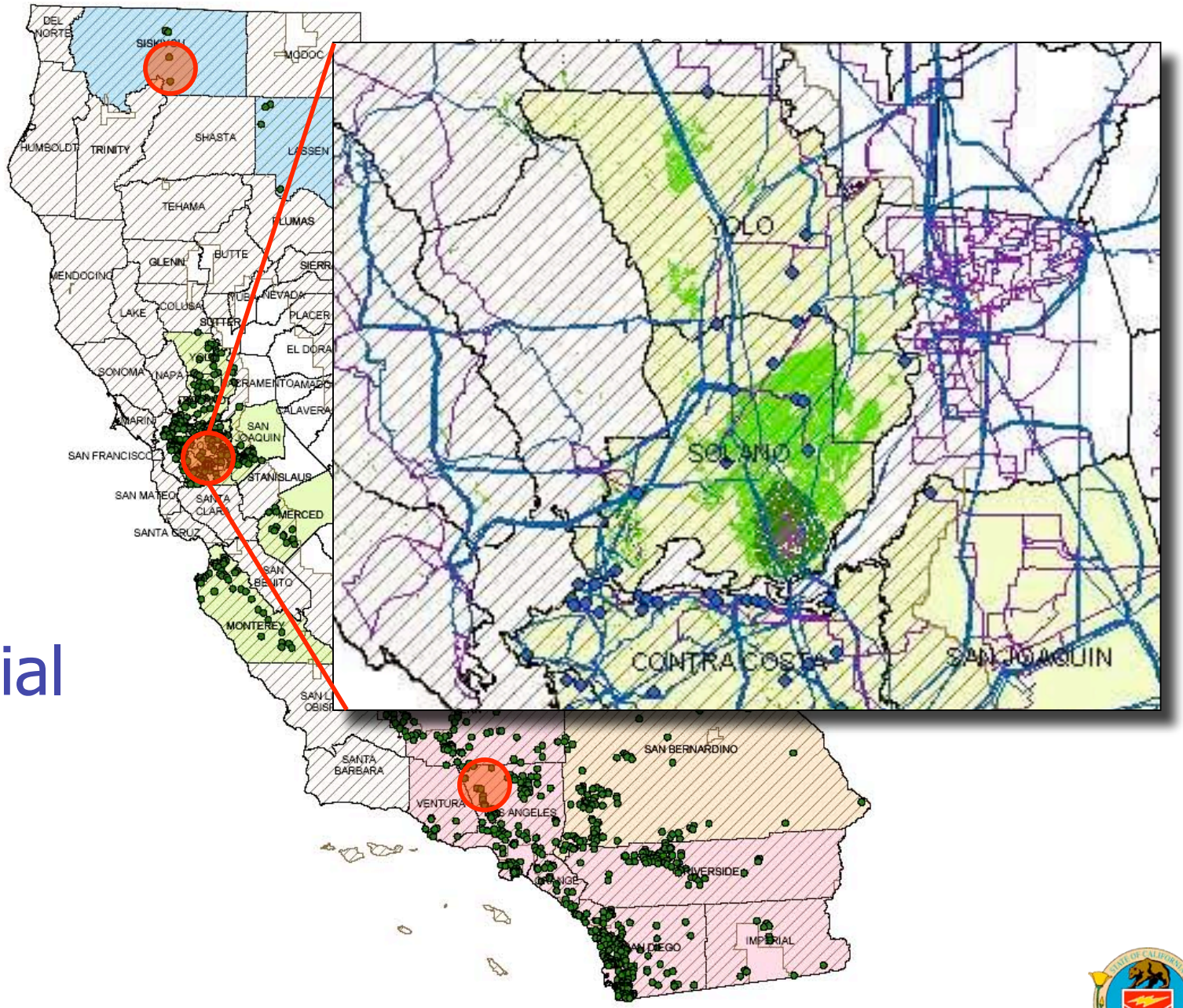


*Example:*

*Potential wind energy injection (MW injection) locations based on resource availability and benefit to grid*

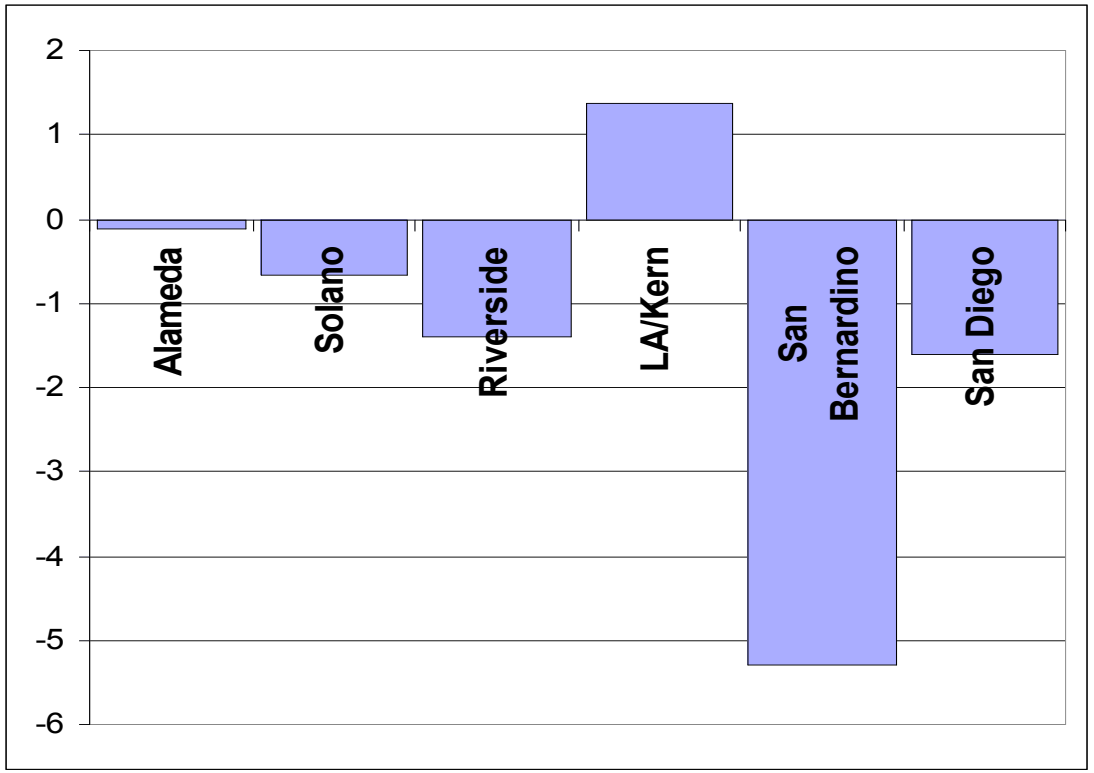


# Low Speed Wind Potential Areas



# Transmission System Impact Ratios

- 19 counties identified for new wind HWS/LWS development
- 6 counties selected for detailed transmission analysis based on wind resource availability, proximity to hotspots, available transmission and economic feasibility
- 2 additional counties in the Tehachapi Resource Area

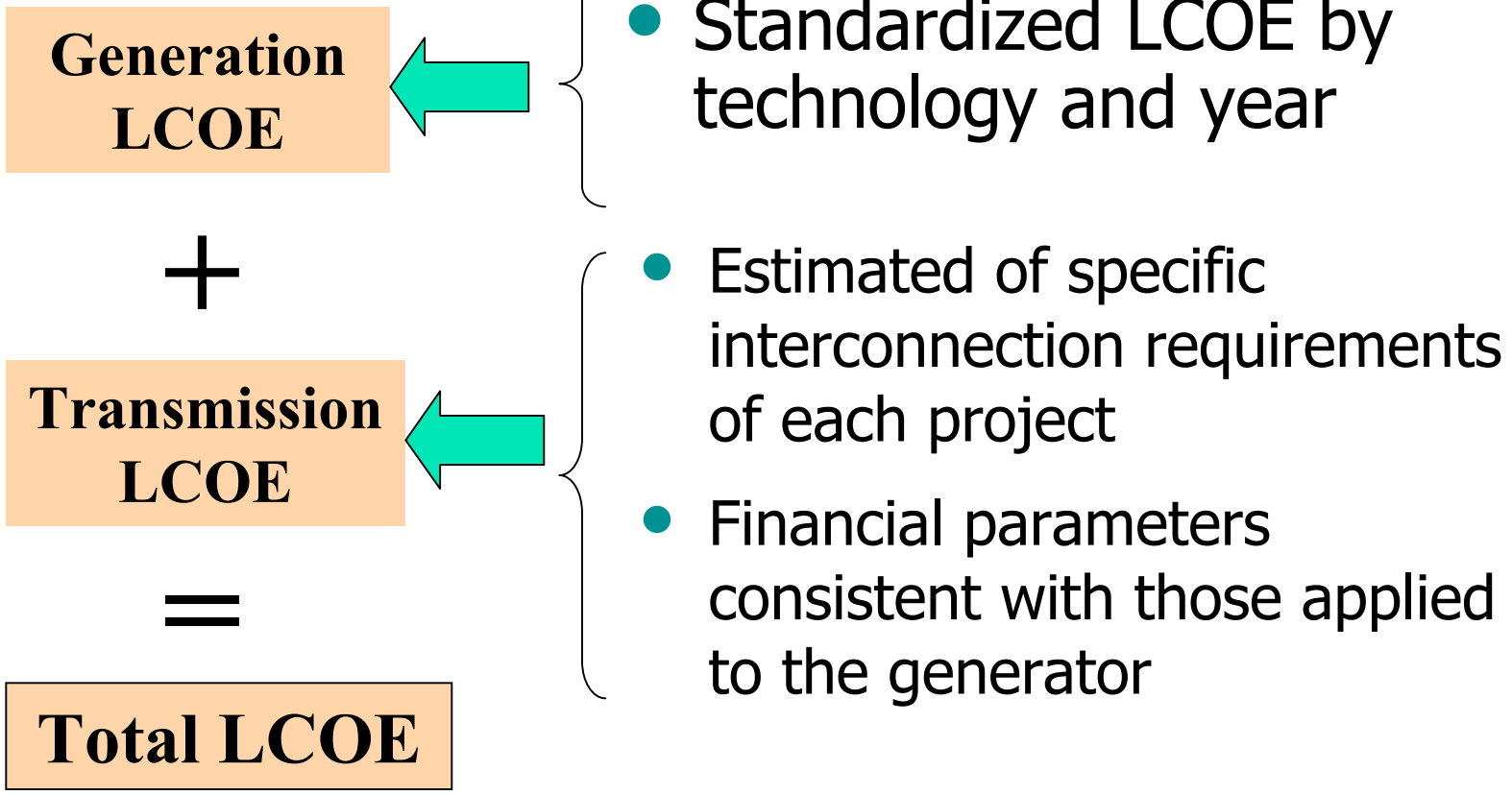



Selected Wind Locations

# Locational Evaluation - Wind

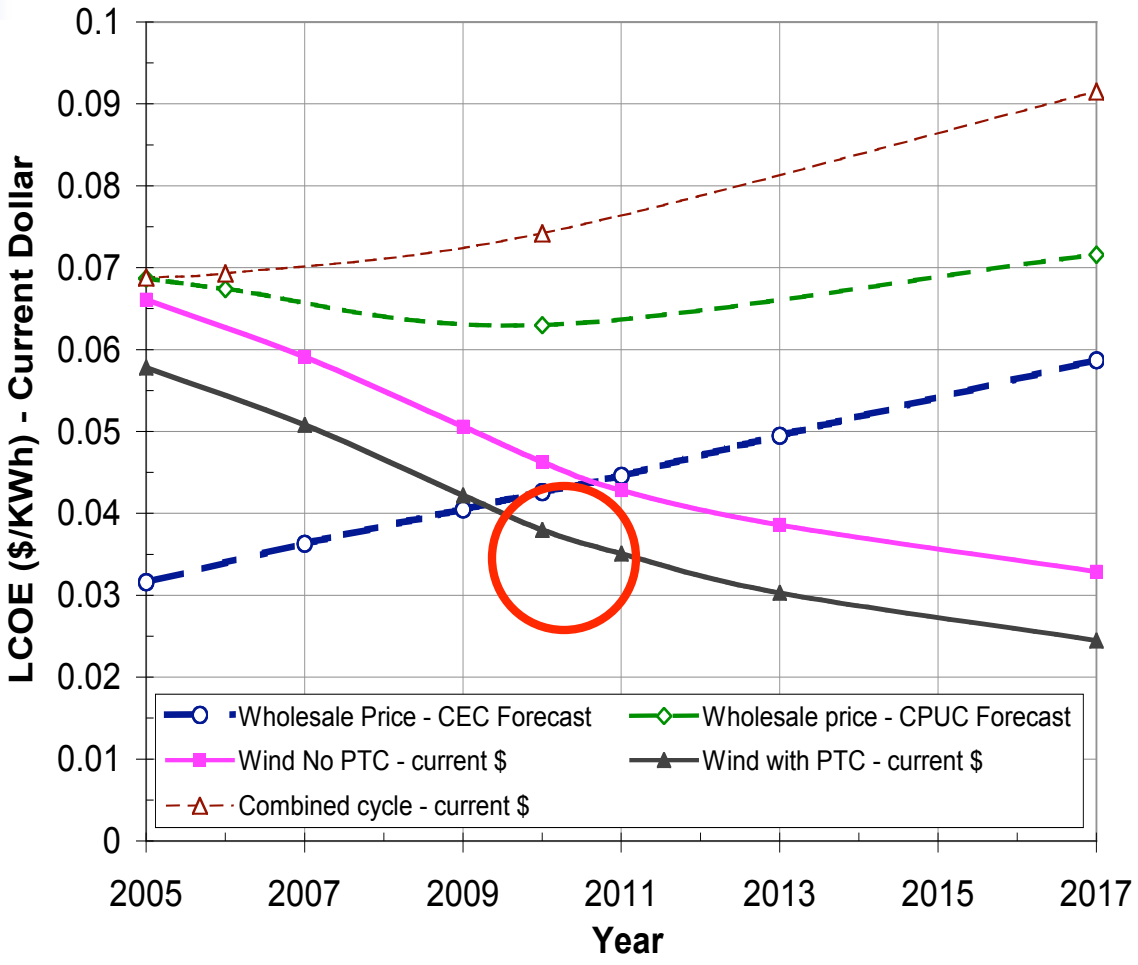
| Counties | High Wind Speed (MW) | Low Wind Speed (MW) |
|---|---|---|
| Alameda | 132 | 490 |
| Solano | 275 | 4,345 |
| Riverside | 1,416 | 3,785 |
| San Bernardino | 280 | 1,621 |
| San Diego | 756 | 2,709 |
| Imperial | 82 | 1,099 |
| Tehachapi Area | | |
| Kern | 2,038 | 3,157 |
| LA | 1,922 | 3,750 |
| **Total** | 6,901 | 20,956 |

# Economic Valuation

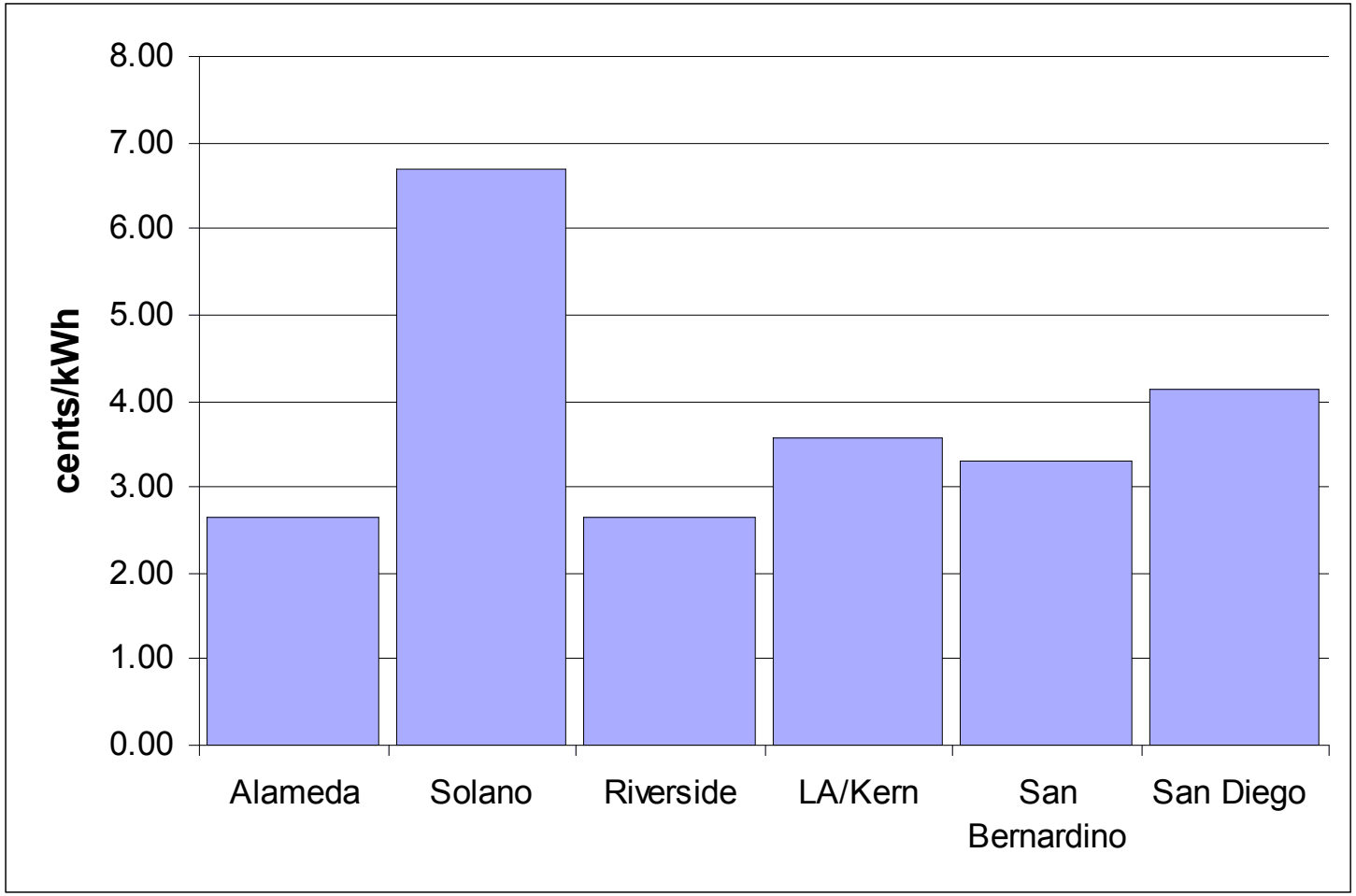



Levelized Cost of Energy (LCOE) in 2004 current dollar

# Economic & LCOE Comparisons



# Temporal Evaluation



# Overall Statewide Solutions

- Overlay renewable technical potential in problem areas
- Develop renewable economic potential
- Complete economic comparisons
  - Transmission & distribution (T&D)
  - Conventional generation
  - Renewables
- Compare environmental benefits associated with developing renewables
  - Improved emissions
  - Increase employment
  - Customer choice
  - Resource diversification

# Next Steps - Integration

- Perform integrated analysis and determine optimal mix of renewable resources
  - All in-state renewable resources
  - Interstate generation potential
  - Regional transmission planning
  - WECC transmission plans
- Determine proper mix of conventional and renewable resources by incorporating power simulation modeling

# Next Steps – Operations

- Match utility resource needs and generating type (base, intermediate, peaking) with renewable technology alternatives
- Incorporate production cost model to determine unit commitment needs and dispatch requirement for impact on operations (note: transmission power flows only look at a snapshot)
- Engage interaction between Commission, CPUC, utilities, regional study groups, CaISO and developers to address issues and ensure timely development and strategic expansion statewide
- Provide feedback using SVA methodology to statewide energy planning future transmission planning

Intermittency Analysis Group
&
SVA-Phase II

# Summary


- Significant wind resource potential in CA
- Significant transmission infrastructure issues
- SVA provides near-term and long-term strategic approach for prioritizing CA *wind* development to meet RPS goals and plan transmission infrastructure
  - Prioritized transmission infrastructure and statewide planning perspective
  - Strategic repowering & development of new high speed wind resources
  - Identifies opportunities for low speed wind technologies, new wind turbine technologies, distributed wind generation (DG) & building integrated wind generation technologies

# Contact Information

California Energy Commission

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